Current trends in Rwanda's HIV/AIDS epidemic

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Objective: To review the trajectory of Rwanda's HIV epidemic, including long term trends and more recent trends in HIV prevalence, markers of HIV incidence, and behavioural indicators.

Methods: This paper reviews the history of HIV serological and behavioural surveillance efforts in Rwanda, dating back to the early 1980s, synthesising findings from surveillance, research, and other relevant HIV programmatic data. The documentation reviewed includes published findings, conference abstracts, and unpublished analyses. Special emphasis is given to more recent sentinel surveillance results and data collected using known, documented methods. Recent trends in HIV prevalence were assessed among sites participating in the three most recent consecutive rounds of antenatal clinic sentinel surveillance.

Results: Early HIV surveillance in Rwanda documented high HIV prevalence in urban areas with HIV widely disseminated into rural areas by 1986. Between 1988 and 1996, HIV prevalence among pregnant women ranged from 21% to 33% in Kigali, from 8% to 22% in other urban settings, and from 2% to 12% in rural settings. More recent surveillance among pregnant women has demonstrated more moderate prevalence, with urban/rural differences narrowing slightly. Between 1998 and 2003, HIV prevalence may have declined in urban areas, whereas rural areas appear to have remained stable. Age at first sexual intercourse is relatively late in Rwanda (20 years for both males and females) and has remained stable since at least 1992.

Conclusions: The present analysis suggests that Rwanda may have experienced declines over the long term in HIV prevalence in urban areas, especially in Kigali, and may have stable or slightly rising HIV prevalence in rural areas. The limited behavioural data available suggest that, on the national level, Rwanda may benefit from a unique combination of low numbers of partners and late sexual debut, which may have had a mitigating effect on HIV prevalence.

Rwanda is a small, landlocked, central African country with a population of 8 162 175,[1] making it Africa's most densely populated country; 83% of the population resides in rural areas. Rwanda was among the first African countries to document AIDS cases in 1983,[2] and subsequent HIV/AIDS surveillance has confirmed that Rwanda's HIV epidemic is longstanding and severe in many settings.

Rwanda's early response to its HIV/AIDS epidemic was relatively rapid and sustained. In 1985, the Ministry of Health and the Red Cross established one of the first and most effective blood donor screening programmes in Africa.[3] In 1986, Rwanda was the first country in the world to conduct and report on a nationally representative HIV seroprevalence survey.[4 5] Also, in 1986, the Ministry of Health, the Red Cross, and the Norwegian Red Cross initiated an extensive AIDS education programme using radio and public health educators.[3] In 1987, the National AIDS Program was established in collaboration with the World Health Organization (WHO).

Rwanda's civil war began in 1990. Between April and July 1994, genocide claimed the lives of an estimated 800 000 Rwandese, displaced nearly 4 million people, and had a devastating impact on national health infrastructure.[6–8] Recent years have been characterised by a dramatic increase in resources to fight the HIV/AIDS epidemic (through the Global Fund, the World Bank, the US government, and others) and a corresponding increase in the availability of services such as voluntary counselling and testing (VCT), prevention of mother-to-child transmission (PMTCT), and antiretroviral therapy (ART). With these resources, the Government of Rwanda has rapidly launched and brought to scale national HIV/AIDS services. VCT services, which first became available in 1997, are now available at 226 sites. PMTCT services began in 1999 and have expanded to 208 sites. Since the introduction of the first ART site in 1999, Rwanda has expanded treatment availability to 83 sites.

In the context of the rapid scale-up of HIV prevention, care, and treatment programmes, it is important to document magnitude and trends in the HIV epidemic. The objective of this paper is to review the trajectory of Rwanda's HIV epidemic, including long term trends and more recent trends in HIV prevalence, markers of HIV incidence, and behavioural indicators.

METHODS

In this paper we review the history of surveillance efforts in Rwanda, dating back to the early 1980s. We have synthesised findings from Rwandan surveillance, research, and other relevant HIV programmatic data, including national and targeted HIV seroprevalence studies, the national sentinel surveillance system, and available behavioural studies. The documentation reviewed includes published findings, conference abstracts, and unpublished analyses. Special emphasis is given to more recent sentinel surveillance results and data collected using documented, internationally accepted methods.

We assessed recent trends in HIV prevalence among sites participating in the three most recent consecutive rounds of antenatal care (ANC) sentinel surveillance. Trends were assessed by site, site setting, age group, and parity with χ^2 tests for linear trend. HIV prevalence among 15–24 year old

Abbreviations: AIDS, acquired immune deficiency syndrome; ANC, antenatal clinic; DHS, Demographic Health Survey; HIV, human immunodeficiency virus; STI, sexually transmitted infection; VCT, voluntary counselling and testing

Table 1 Summary of HIV prevalence at ANC sentinel surveillance sites, Rwanda 1998–2003

		Kigali		Other urban		Rural	
Year	No. of sites	Median prevalence	Range (no. of sites)	Median prevalence	Range (no. of sites)	Median prevalence	Range (no. of sites)
1998	10	16.5	14.7–18.2 (2)	10.2	7.1–13.2 (5)	3.3	2.3–6.2 (3)
2002	24	13.0	13.0–13.0 (2)	6.7	3.7–8.3 (9)	3.0	1.2–5.1 (12)
2003	24	13.2	10.2–16.2 (2)	6.3	3.1–9.3 (9)	2.8	1.2–5.6 (12)

women and among primiparous women was considered as a proxy for HIV incidence.

We defined urban and rural classifications for surveillance sites in accordance with Rwandan government conventions, with the ''other urban'' classification further distinguishing between Kigali and urban areas outside of the capital city.[9]

RESULTS

Rwanda's HIV/AIDS surveillance efforts began in 1984 with the establishment of a national AIDS case reporting system in hospitals and health centres. AIDS case definitions used in Rwanda have changed over time, with the current WHO case definition for AIDS surveillance in use since 1998. Between 1990 and 2002, the system recorded steadily increasing numbers of new AIDS cases with between 1000 and 4000 new case reports per year. This was followed more recently by dramatic increases in cases in 2003 and 2004 (over 6000 and 12 000 cases reported, respectively) as a result of improved reporting and the growing availability of HIV testing, care, and treatment services in Rwanda since 2000 (Ministry of Health, Health Information System, unpublished data, 2004).

The first nationally representative household HIV seroprevalence survey was completed in 1986 using probability proportionate to size cluster sampling. Thirty urban and 30 rural clusters were selected for a total sample size of 2820 individuals. The survey demonstrated substantial urban/rural differences in HIV prevalence, with an estimated urban prevalence of 17.8% and a rural prevalence of 1.3%.[4 5] Peak HIV prevalence was observed in the 26–40 year age group in both urban and rural samples (30.0% and 2.8%, respectively). A national HIV prevalence estimate of approximately 2% was calculated from the study.[5]

In 1997, a more limited household HIV seroprevalence survey was carried out among 30 clusters in each of the catchment areas surrounding five ANC sentinel surveillance sites.[10] A total of 4750 individuals were included in the survey. An overall HIV prevalence of 11.1% was reported from this survey, and little difference was detected between urban and rural prevalence (12.5% and 10.8%, respectively).

Several other HIV seroprevalence studies were carried out in specific groups of interest in Kigali and in other urban settings in Rwanda between 1986 and 1995.[3 11–14] These special studies were not part of the national sentinel surveillance system, but instead were designed to address specific research questions using various methods. Observed HIV prevalence among pregnant women ranged from 9.3% in 1991 in Butare (Rwanda's second largest city) to 32% in 1988 at Kigali's largest hospital. Surveys among commercial sex workers conducted in Butare in 1983 and 1984 documented extremely high HIV prevalence (75% and 88%, respectively).[15]

In 1988, Rwanda established its HIV sentinel surveillance system among ANC attendees and patients with STIs at select sites throughout the country. Leftover specimens from routine clinical services in these settings were anonymously tested for HIV. The first three sentinel surveillance rounds were conducted in 1988, 1991, and 1996. For this period, HIV prevalence in four Kigali sentinel ANC sites ranged from 20.6% to 32.6% (median 25.7%). At four other urban sites outside Kigali, observed prevalence ranged from 8.2% to 21.6% (median 9.9%). At 10 rural sites, prevalence ranged from 2.0% to 12.3% (median 2.6%). During the same years, the sentinel surveillance system also documented high levels of HIV prevalence among STI patients surveyed at a total of five sites over two rounds of surveillance ranging from 23.3% to 65.5% (median 56.5%).[16]

The national sentinel surveillance system was expanded and improved in 2002 to include a total of 24 sentinel ANC sites, with two sites in each of Rwanda's 12 provinces, to approach more representative national coverage. The number of rural sites in the system increased from three to 12, and the number of ''other urban'' sites increased from five to nine. In order to improve precision of prevalence estimates, sample sizes per site were increased in 2002. The average sample size per sentinel site increased from 385 in 1998 to 489 and 484 in 2002 and 2003, respectively. Quality control for serological testing and site supervision were also strengthened.[17]

Table 1 presents a summary of HIV prevalence figures from all sites surveyed during the three most recent rounds of ANC sentinel surveillance. In general, HIV prevalence is consistently highest in the capital Kigali, followed by other urban areas, with more moderate prevalence recorded in rural sites. Between 1998 and 2003, in two Kigali sites observed HIV prevalence ranged from a high of 18.2% in 1998 to 10.2% in 2003.[17 18] HIV prevalence in rural sites was consistent over the six year period at approximately 3%. Kigali and ''other urban'' sites show more variation in HIV prevalence with the 1998 survey registering the highest levels.

Recent trends in HIV prevalence from ANC sites were assessed using only those six sentinel sites that were included in the three most recent rounds of sentinel surveillance. Figure 1 illustrates that prevalence at two rural sites in Kigali Ngali and Kibungo provinces has remained relatively stable, whereas Kigali and ''other urban'' sites (in Kibungo and Byumba provinces) recorded significant declines since 1998. However, in 2002 and 2003 these declines were less evident.

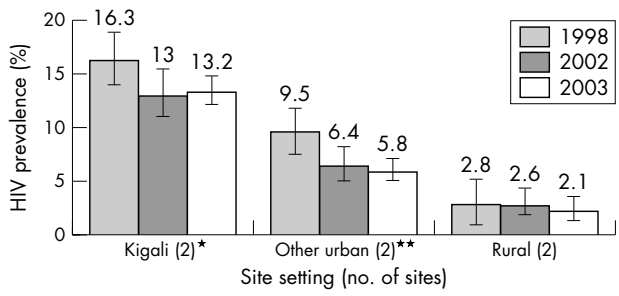

Figure 1 Trends in HIV prevalence by site setting and year of survey, in the six sentinel ANC sites participating in three rounds of surveillance, Rwanda 1998–2003. *χ^2 for trend p=0.03 **χ^2 for trend p<0.01.

Table 2 HIV prevalence trends at ANC sentinel surveillance sites by site setting, age group, and at first pregnancy, Rwanda 1998–2003

	Kigali				Other urban				Rural			
	1998	2002	2003	p*	1998	2002	2003	p*	1998	2002	2003	p*
15–24	13.1	9.8	10.3	0.09	8.6	5.8	5.0	0.04	2.9	2.0	2.1	0.42
25–34	19.9	15.0	15.4	0.06	11.1	8.0	6.3	0.01	2.4	3.9	2.7	0.54
35–49	16.7	10.7	21.5	0.78	7.5	3.6	6.6	0.50	1.8	0.6	0.7	0.31
First pregnancy	13.3	10.8	8.2	0.05	6.7	4.8	4.8	0.38	3.1	0.5	1.0	0.04

*p value for χ^2 for linear trend.

Trends in individual sites were also considered. Two urban sites (one in Kigali and one in Kibungo) appear to have declining HIV prevalence since 1998, and in both rural sites no trends were evident (data not shown).

In order to discern possible trends in HIV incidence, table 2 presents HIV prevalence by age group and at first pregnancy for each site setting. In Kigali, as well as in ''other urban'' sites, there is a general decline in prevalence evident in the youngest age group; however, this decline is significant only in the ''other urban'' site grouping. No clear trends were evident in the youngest age group in rural sites. When considering HIV prevalence levels among women attending ANC for their first pregnancy, significant declines were noted in Kigali sites and in rural sites.

The availability of behavioural data on the population level in Rwanda is limited, and repeated surveys with similar methods and populations have not been conducted. Therefore, assessing trends in behaviours is not currently possible. However, some key behavioural indicators are available from selected surveys. The Demographic Health Survey (DHS) is conducted in Rwanda every five years with a nationally representative sampling scheme described elsewhere.[19 20] The most recent survey conducted in 2000 documents a relatively late sexual debut in Rwanda among both males and females (median age 20.6 and 20.1, respectively), with individuals in urban and rural areas reporting similar age of sexual debut. Between the 1992 and 2000 surveys, the median age of sexual debut among females may have increased slightly from 19.7 to 20.1.[19 20] A large behavioural survey conducted in 2000 among 15–19 year olds in six of Rwanda's 12 provinces showed that 29% of males and 12% of females surveyed reported ever having had sexual intercourse. Another survey conducted in Butare province in 2002 found that among 15–19 year olds, 12.2% of males and 5.6% of females were sexually active.[21]

In the general population, Rwandans report low levels of multiple sexual partnerships. In the 2000 DHS, of all women in a partnership, only 0.6% report more than one sexual partner in the preceding 12 months, and among single women the figure is 0.4%. Of men in partnerships, only 1.8% report more than one sexual partner in the preceding 12 months, and among single men the figure is 1.6%.[20]

Information on condom use is limited and somewhat varied. In the 2000 behavioural survey, 10% of sexually active youth (15–19 years) reported ever having used a condom.[22] In other studies among higher risk groups, condom use is more frequently reported. Reported rates of condom use among commercial sex workers surveyed in 2000 are high, with 81% reporting using a condom at last sex.[23] Among lorry drivers surveyed in 2000, 63% reported condom use at last sex with an occasional partner, and 91% use at last sex with a commercial sex worker.[24]

DISCUSSION

Early surveillance data indicate an explosive HIV/AIDS epidemic in Rwanda, with a high urban prevalence and widely disseminated HIV infection in rural areas of the country by 1986. This is similar to the early course of the epidemic in neighbouring countries.[25]

With the exception of one survey conducted in 1997, urban/rural differences in HIV prevalence have been well documented since 1986 and continue to the present, although the magnitude of these differences appears to have narrowed over time. In 1986, an urban prevalence of 17.8% and a rural prevalence of 1.3% were recorded. Recent sentinel surveillance shows somewhat lower urban prevalence than during the 1980s, and substantially higher rural prevalence on the order of a twofold to threefold increase. This is suggestive of a general trend toward declining prevalence in urban Rwanda, after a peak at some point in the late 1980s or early 1990s, and slowly increasing prevalence in rural Rwanda. There are methodological issues that limit more definitive conclusions from the data. Sites selected for seroprevalence surveys have changed since the 1980s. For example, many key early seroprevalence studies were conducted among pregnant women at the largest reference hospital in Kigali, whereas more recent prevalence data from Kigali come from sentinel health centre sites. It is possible, therefore, that the hospital based studies of the 1980s and early 1990s were conducted among a higher risk group of pregnant women than the more recent surveillance. In addition, prevalence estimates obtained using a population based sample such as the 1986 survey and more recent ANC sentinel surveillance data should be compared cautiously due to the different populations surveyed and different methods used.

The 1997 survey conducted in areas surrounding five ANC sentinel sites did not detect significant differences between urban and rural HIV prevalence. Despite the limited geographical scope of the survey, these results have been interpreted as indicative of national HIV prevalence levels, and have also led to the conclusion that differences in levels of HIV prevalence in urban and rural Rwanda had disappeared in the aftermath of the war. Given the clear urban/rural prevalence differences that continue to be documented through sentinel surveillance, the interpretation of the 1997 survey appears to have been inaccurate; urban areas have markedly higher HIV prevalence than rural areas.

Careful consideration of trends in recent HIV prevalence is important, not only for policy development and programme planning, but also to corroborate the long term trends suggested above. In the past six years, HIV prevalence remains highest in Kigali, with more moderate prevalence in ''other urban'' and rural settings. There are indications that HIV prevalence and incidence may be decreasing in Kigali, including significant declines among primiparous women and overall prevalence declines since 1998, however, no behavioural trend data or other evidence are available to explain these observations. Rural prevalence shows no signs of decline during this period. These two trends in the short term (urban prevalence possibly declining, with rural trends undetectable) are consistent with the long term trends proposed above. Certain methodological considerations relating to the analysis of recent trends should be noted.

Assessing trends in prevalence is best achieved by comparing rates in the same sentinel sites over time. Rwanda's surveillance system has data from a limited number of years in which the same sites were used, reducing our ability to detect clear trends. Also, the convention of using HIV prevalence among the youngest women as a proxy for HIV incidence is known to provide only a general indication of true incidence. In Rwanda, late sexual debut among women makes analysis of the 15–19 year age group more difficult, due to a low number of pregnant women in the youngest age groups. The incidence analysis therefore considered both the 15–24 year age group and primiparous women as indicators of potential new infections.[26]

National HIV prevalence estimates have varied widely over the past decade, and have been revised downward during that time. The Joint United Nations Programme on AIDS (UNAIDS) national estimates for Rwanda have declined from 12.8% in 1998 to 5.2% in 2004.[27 28] The most recent revised prevalence estimates by the Rwandan Ministry of Health are consistent with the current UNAIDS estimate and present an upper limit for rural prevalence of 4% and an upper limit for urban prevalence of 11%.[29] Although some of the changes may reflect actual declining prevalence, an important part of the change is likely due to improvements in surveillance methodology over time, specifically increased coverage of sentinel sites outside of Kigali, especially in rural areas of the country, where relatively lower prevalence has been measured. The massive mortality and displacement of the Rwandan population during and after the 1994 war are likely to have influenced HIV prevalence patterns in the country during this period, although the magnitude and direction of these changes cannot be discerned from available data.

Given the limited behavioural data available in Rwanda, it is difficult to speculate on changes in sexual behaviour over time. However, Rwanda's relatively late and stable sexual debut figures and the infrequency of multiple sex partners are well documented in two nationally representative DHS surveys, and sexual behaviour information from smaller surveys among youth is consistent with late sexual debut. These data describe a somewhat unique and potentially protective environment against a more explosive spread of HIV on a population level, and may have allowed Rwanda to avoid reaching sustained national prevalence at a much higher level than it apparently has. Kigali presents an exception to this national picture: higher risk sexual behaviour in Rwanda's only major city is consistent with the markedly higher HIV prevalence observed there. Similarly, condom use among some urban high risk groups, such as lorry drivers and commercial sex workers, was relatively high in 2000, and may be contributing to slowing the spread of HIV.

SUMMARY AND FUTURE DIRECTIONS

In spite of the acknowledged limitations of available data, the present analysis suggests that Rwanda may have experienced declines over the long term in HIV prevalence in urban areas, especially in Kigali, and may have stable or rising HIV prevalence in rural areas. In recent years, Rwanda's surveillance system has been significantly strengthened and is well positioned to provide more conclusive data in the near future. The expanded HIV sentinel surveillance system will continue in 2005 in at least 24 sites, providing critical new information on recent trends. Rwanda is currently conducting its second nationally representative household HIV seroprevalence survey (RDHS+), which will provide national and regional HIV prevalence estimates, and which will allow for adjustments to national estimates derived from ANC sentinel surveillance. Rwanda also plans to conduct HIV incidence studies using new serological methods to measure more accurately absolute levels of recent HIV infections and emerging trends in incidence.

Key message

Rwanda's surveillance data demonstrate clear differences in HIV prevalence between urban and rural settings, with urban areas more seriously affected, especially the capital, Kigali. There is growing evidence that HIV prevalence is declining in urban areas in Rwanda.

CONTRIBUTIONS OF AUTHORS

E Kayirangwa and A Kabeja lead the Epidemiology Unit at the Treatment and Research AIDS Center and have managed all aspects of the ANC sentinel surveillance system since 2001. L Munyakazi, Director of the Treatment and Research AIDS Center, supervised surveillance efforts and provided review and interpretation of the data. J Hanson has provided technical assistance to the Treatment and Research AIDS Center in conducting HIV surveillance since 2001. The paper was prepared primarily by E Kayirangwa and J Hanson.

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